

**OROVILLE FERC RELICENSING  
(PROJECT No. 2100)**

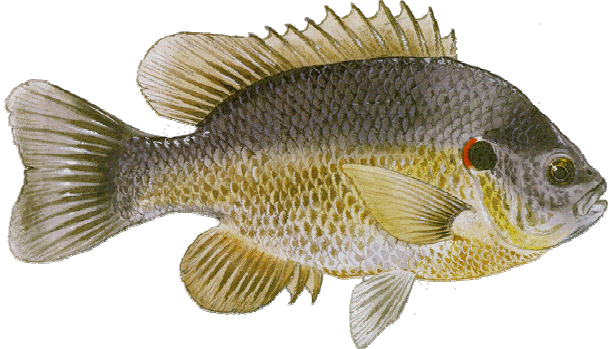
**INTERIM REPORT  
SP-F3.2 TASK 2  
SP-F21 TASK 1**

**APPENDIX A  
MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR  
FEATHER RIVER FISH SPECIES**

**LITERATURE REVIEW OF LIFE HISTORY AND  
HABITAT REQUIREMENTS FOR  
FEATHER RIVER FISH SPECIES**

**REDEAR SUNFISH**

**JANUARY 2003**

Element	Element Descriptor	General	Feather River Specific
<b>General</b>			
common name (s)	English name (usually used by fishers and laypeople).	Redear Sunfish	
scientific name (s)	Latin name (referenced in scientific publications).	<i>Lepomis microlophus</i>	
taxonomy (family)	Common name of the family to which they belong. Also indicate scientific family name.	Sunfish and Bass - <i>Centrarchidae</i>	
depiction	Illustration, drawing or photograph.		
range	Broad geographic distribution, specifying California distribution, as available.	<p>Redear sunfish are native to the southeastern U.S., including Florida, and to the Rio Grande and lower Mississippi river systems. Redear sunfish are widely planted throughout the warmer regions of the U.S., Morocco, South Africa, Panama, and Puerto Rico (Moyle 2002).</p> <p>Redear sunfish are native to the Mississippi River and eastward to Florida, and were introduced to the Colorado River and southern California in the 1950s (Wang 1986).</p>	
native or introduced	If introduced, indicate timing, location, and methods.	Redear sunfish were introduced to the lower Colorado River in 1948 or 1949 and first collected in California in 1951. They have since been introduced to southern California, the Russian River, and the Central Valley (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
ESA listing status	Following the categories according to California Code of Regulations and the Federal Register, indicate whether: SE = State-listed Endangered; ST = State-listed Threatened; FE = Federally listed Endangered; FT = Federally-listed Threatened; SCE = State Candidate (Endangered); SCT = State candidate (Threatened); FPE = Federally proposed (Endangered); FPT = Federally proposed (Threatened); FPD = Federally proposed (Delisting); the date of listing; or N = not listed.	Redear sunfish are not listed.	
species status	If native, whether: Extinct/extirpated; Threatened or Endangered; Special concern; Watch list; Stable or increasing. If introduced, whether: Extirpated (failed introduction); highly localized; Localized; Widespread and stable; Widespread and expanding.	The status of redear sunfish is “widespread and stable” (Moyle 2002).	
economic or recreational value	Indicate whether target species sought for food or trophy. Whether desirable by recreational fishers, commercial fishers, or both.	Redear sunfish are desired by recreational fishers, although they are harder to catch than bluegill and many anglers do not even know they exist (Moyle 2002).	
warmwater or coldwater	Warmwater if suitable temperature range is similar to basses; coldwater if suitable temperature range is similar to salmonids.	Redear sunfish are warmwater fish.	
pelagic or littoral	Environment: Pelagic - living far from shore; Littoral - living near the shore.	Redear sunfish are a littoral, freshwater fish.	

Element	Element Descriptor	General	Feather River Specific
bottom or water column distribution	Environment: bottom (benthic) or along water column.	Redear sunfish live in relatively deep waters, near the bottom of ponds, lakes, river backwaters, and sloughs (Moyle 2002).	
lentic or lotic	Environment: Lentic - pertaining to stagnant water, or lake-like; Lotic - moving water, or river-like.	Redear sunfish inhabit lentic environments (Moyle 2002).	
<b>Adults</b>			
life span	Approximate maximum age obtained.	Redear sunfish live 7 years and mature at 1 to 2 years (Moyle 2002).  Redear sunfish mature during their second summer, though in California this may be delayed until they are 3 to 4 years of age (Wang 1986).	
adult length	Indicate: Length at which they first reproduce; average length and maximum length the fish can attain.	Growth rates of redear sunfish are highly variable; 3-year-olds average 7 to 7.5 inches (178 to 190 millimeters), 4-year-olds average 8.5 to 8.8 inches (216 to 224 millimeters); mature adults are 5.1 to 7.1 inches (13 to 18 centimeters) in length (Moyle 2002).	
adult weight	Indicate: Weight at which they first reproduce; average weight and maximum weight the fish can attain.	The maximum weight of a redear sunfish is 5.3 pounds (2.4 kilograms) (Moyle 2002).	
physical morphology	General shape of the fish: elongated, fusiform, laterally compressed, etc.	Redear sunfish are deep bodied (Moyle 2002).	
coloration	Indicate color, and color changes, if any, during reproduction phase.	Adult redear sunfish are olive on the back, pale mottled brown to silvery on the sides, usually with some speckling, and often fairly bright yellow on the lower sides and the belly. They have an orange-red edge ahead of the dark blotch on the opercular flap. Young-of-year may have 7 to 8 faint vertical bars on the sides, and the dorsal fin is dusky (Moyle 2002).	
other physical adult descriptors	Unique physical features for easy identification.	There is an absence of conspicuous patterns on either the sides or the fins of redear sunfish (Moyle 2002).	
adult food base	Indicate primary diet components.	Redear sunfish pick hard shelled invertebrates, especially snails and clams, from the lake- or river-bottom and aquatic plants. Redear sunfish also eat bottom dwelling insect larvae (dragonfly, midge, mayfly larvae) and amphipods (Moyle 2002).	

Element	Element Descriptor	General	Feather River Specific
adult feeding habits	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder.	Redear sunfish are bottom feeders and crush prey with their teeth; the soft parts are swallowed and the hard parts are ejected (Moyle 2002).	
adult in-ocean residence time	For anadromous species, age when they migrate to the ocean and duration spent in the ocean before returning to freshwater to spawn.	N/A	
adult habitat characteristics in-ocean	For anadromous species, description of the ocean habitat utilized: whether along major current systems, gyres, pelagic (beyond continental shelves) and neritic (above continental shelves) zones, etc.	N/A	
<b>Adult upstream migration (immigration)</b>			
range of adult upstream migration timing	Time of year adults migrate upstream. If applicable, indicate for various runs.	N/A	
peak adult upstream migration timing	Time of year most adults migrate upstream. If applicable, indicate for various runs.	N/A	
adult upstream migration water temperature tolerance	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
adult upstream migration water temperature preference	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	N/A	

Element	Element Descriptor	General	Feather River Specific
<b>Adult holding (freshwater residence)</b>			
water temperature tolerance for holding adults	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for holding adults	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.		
water depth range for holding adults	Reported range of observed (minimum and maximum) water depth utilization.	Redear sunfish are most abundant in waters more than 78.7 inches (2 meters) deep (Moyle 2002).	
water depth preference for holding adults	Reported range of most frequently observed water depth utilization.		
substrate preference for holding adults	If bottom dwellers, indicate substrate: mud, sand, gravel, boulders, aquatic plant beds, etc. If gravel, indicate range or average size of gravel.		
water velocity range for holding adults	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocity preference for holding adults	Reported range of most frequently observed water velocity utilization.		
other habitat characteristics for holding adults	General description of habitat (e.g. turbid or clear waters, lentic or lotic, presence of aquatic plant beds, debris, cover, etc.).	Redear sunfish inhabit deeper waters of warm, quiet ponds, lakes, river backwaters, and sloughs with substantial beds of aquatic vegetation (Moyle 2002).	
timing range for adult holding	Time of year (earliest-latest) and duration of stay from upstream migration to spawning.	N/A	

Element	Element Descriptor	General	Feather River Specific
timing peak for adult holding	Time of year when maximum number of adults are present before spawning.	N/A	
<b>Spawning</b>			
fecundity	Average or range in the number of eggs females lay in a spawning season.	Redear sunfish produce 9,000 to 80,000 eggs (Moyle 2002).  Redear sunfish produce 120 to 4,000 eggs by stripping (Wang 1986).	
nest construction	Location and general description of nest -- substrates, aquatic plants, excavations, crevices, habitat types, etc.	Redear sunfish construct nests on sandy, gravelly, and muddy river or lake bottoms, usually at a wide range of depths (Moyle 2002).	
nest size	Size and average dimensions of the nest.	Redear sunfish nests range from 9.8 to 24 inches (25 to 61 centimeters) in diameter, and are typically 13.8 to 17.7 inches (35 to 45 centimeters) in diameter and 2 to 3.4 inches (5 to 10 centimeters) deep (Moyle 2002).	
spawning process	Indicate whether nest builder, broadcast spawner, or other.	Redear sunfish spawning behavior is similar to most sunfish, especially pumpkinseed, in that males make species-specific popping noises during courtship (Moyle 2002).  Redear sunfish are nest builders.	
spawning substrate size/characteristics	Range of substrates used during spawning (e.g. mud, sand, gravel, boulders, beds of aquatic plants). Indicate presence of plant/wood debris, crevices at spawning sites. If gravel, indicate range of average size.	Redear sunfish nests are constructed in gravel, sand, and hard clay (Wang 1986).  Redear sunfish nests are constructed in sand, gravel, or mud (Moyle 2002).	
preferred spawning substrate	Indicate preferred spawning substrate (e.g. mud, sand, gravel, boulders, plant bed, etc).	Redear sunfish prefer to spawn in shallow waters of ponds and reservoirs in gravel, sand, and hard clay (Wang 1986).	
water temperature tolerance for spawning	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Spawning of redear sunfish takes place when water temperatures reach 69.8°F to 75.2°F (21°C to 24°C) (Moyle 2002).  Spawning of redear sunfish begins when water temperatures approach 70°F (21.1°C), and generally occurs when water temperatures are 71.6°F to 75.2°F (22°C to 24°C) (Wang 1986).	

Element	Element Descriptor	General	Feather River Specific
water temperature preference for spawning	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
water velocity range for spawning	Minimum and maximum speed of water current the spawning fish can tolerate.		
water velocity preference for spawning	Preferred water current (flow velocity) during spawning.		
water depth range for spawning	Reported range of observed (minimum and maximum) water depth utilization.	In Rancho Seco, redear sunfish have constructed nests in water between 1.6 to 4.6 feet (0.5 to 1.4 meters) deep and between 13.1 to 19.7 feet (4 to 6 meters) deep (Moyle 2002).  Redear sunfish construct nests at water depths ranging from 5.9 to 9.8 feet (1.8 to 3 meters) (Wang 1986).	
water depth preference for spawning	Reported range of most frequently observed water depth utilization.		
range for spawning timing	Earliest and latest time of season or year in which spawning occurs.	Redear sunfish spawn throughout the summer, beginning as early as mid-April (Moyle 2002).  Redear sunfish spawn from May through September in Tennessee, from spring to fall in Alabama, and from April to August in California (Wang 1986).	
peak spawning timing	Time of year most fish start to spawn.	Redear sunfish peak spawning occurs in the spring (Wang 1986).  In Rancho Seco, there were 2 peak spawning periods: one in mid-April through early May, and one in July (Moyle 2002).	
spawning frequency (iteroparous/semelparous)	Semelparous - producing all offspring at one time, such as in most salmon. Usually these fish die after reproduction. Iteroparous - producing offspring in successive, e.g., annual or seasonal batches, as is the case in most fishes.	Redear sunfish are iteroparous (Wang 1986).	



Element	Element Descriptor	General	Feather River Specific
<b>Incubation/early development</b>			
egg characteristics	Shape, size, color, in clusters or individuals, stickiness, and other physical attributes.	Redear sunfish eggs are spherical, 0.05 to 0.06 inches (1.3 to 1.6 millimeters) in diameter, adhesive, and demersal (Wang 1986).	
water temperature tolerance for incubation	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Redear sunfish larvae were collected at 72.5°F (22.5°C) (Wang 1986).  The suitable temperature for redear sunfish egg incubation is 74.5°F (23.6°C) (Wang 1986).	
water temperature preference for incubation	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
time required for incubation	Time duration from fertilization to hatching. Note: Indicate at which temperature range. Incubation time is temperature-dependent.	Redear sunfish egg incubation lasts 50 hours (Wang 1986).	
size of newly hatched larvae	Average size of newly hatched larvae.	The maximum length of redear sunfish larvae is 0.2 inches (5.0 millimeters) (Wang 1986).	
time newly hatched larvae remain in gravel	Time of year of hatching, and duration between hatching and emergence from gravel.	Redear sunfish larvae remain in gravel the for a short period until they disperse freely into weedy areas (Wang 1986).	
other characteristics of larvae	Alevin -- early life history phase just after hatching (larva) when yolk-sac still present.	Initially, Redear sunfish larvae are planktonic, before settling into beds of aquatic plants (Moyle 2002).	
timing range for emergence	Time of year (earliest-latest) hatchlings (larvae and alevins) leave or emerge from the nesting/hatching (gravel) sites.		
timing peak for emergence	Time of year most hatchlings emerge.		
size at emergence from gravel	Average size of hatchlings at time of emergence.		

Element	Element Descriptor	General	Feather River Specific
<b>Juvenile rearing</b>			
general rearing habitat and strategies	General description of freshwater environment and rearing behavior.		
water temperature tolerance for juvenile rearing	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preference for juvenile rearing	Range of suitable, preferred, or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
water velocity ranges for rearing juveniles	Reported range of observed (minimum and maximum) water velocity utilization.		
water velocities preferred by rearing juveniles	Reported range of most frequently observed water velocity utilization.		
water depth range for juvenile rearing	Reported range of observed (minimum and maximum) water depth utilization.		
water depth preference for juvenile rearing	Reported range of most frequently observed water depth utilization.		

Element	Element Descriptor	General	Feather River Specific
cover preferences for rearing juveniles	Type of cover for protection from predators used by rearing juveniles (e.g. crevices, submerged aquatic vegetation, overhanging vegetation, substrate cover, undercover bank, small woody debris, large woody debris).	Juvenile redear sunfish stay close to or in aquatic plant beds, often in small shoals (Moyle 2002).  Juvenile redear sunfish inhabit shallow coves of ponds and reservoirs, near or among vegetation (Wang 1986).	
food base of juveniles	Indicate primary diet components. Also indicate the diet changes, if any, as growth occurs.	Juvenile redear sunfish eat insect larvae and small crustaceans; large juveniles eat small snails (Wang 1986).  Juvenile redear sunfish eat chironomids, insect larvae, and crustaceans (Moyle 2002).	
feeding habits of rearing juveniles	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder. Also indicate change of feeding habits growth occurs.	Juvenile redear sunfish are active hunters (Moyle 2002).	
predation of juveniles	Indicate which species prey on juveniles.	Largemouth bass prey on juvenile redear sunfish (Savitz et al. 1982).	
timing range for juvenile rearing	Range of time of year (months) during which rearing occurs.	N/A	
timing peak for juvenile rearing	Time of year (months) during which most rearing occurs.	N/A	
<b>Juvenile emigration</b>			
time spent in fresh water prior to emigrating	Duration (in years and/or months) from emergence to emigration to the ocean.	N/A	
water temperature tolerances during emigration	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	N/A	
water temperature preferences during emigration	Range of suitable, preferred or reported optimal water temperatures. Indicate whether	N/A	

Element	Element Descriptor	General	Feather River Specific
	literature, observational, or experimental derivation.		
emigration timing range	Time of year juveniles commence emigration and duration of emigration.	N/A	
emigration timing peak	Time of year most juveniles are emigrating.	N/A	
size range of juveniles during emigration	Minimum and maximum sizes (inches or mm) of emigrating juveniles. Indicate average size.	N/A	
factors associated with emigration	Pulse flows, water temperature changes, turbidity levels, photoperiod, etc.		
<b>Other potential factors</b>			
DO	Levels of dissolved oxygen in water expressed in mg/l tolerated by fish.		
pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.		
turbidity	Indicate turbidity or state of water (e.g., clear water or presence of siltation or organic/inorganic matter in water) that fish can tolerate.	Reproduction and growth of redear sunfish are inhibited in water that is too turbid (Moyle 2002).	
factors contributing to mortality	e.g. fishing/angling mortality, drastic habitat alterations, unfavorable climatic changes, etc.	Mortality of redear sunfish is caused by fishing/angling (Moyle 2002).	

## References

- Moyle, P. B. 2002. Inland Fishes of California. Berkeley: University of California Press, 385 pgs.
- Savitz, J. and J. Janssen. 1982. Utilization of Green Sunfish and Bluegills by Largemouth Bass: Influence of Ingestion Time. Transactions of the American Fisheries Society 111:462-464.
- Wang, J. 1986. Interagency Ecological Program Technical Report #9. January 1986. Fishes of the Sacramento-San Joaquin Estuary and Adjacent Waters, California: A Guide to the Early Life Histories. Redear Sunfish- *Lepomis microlophus*.